

**PARTIAL**  
**STURAA TEST**  
**12 YEAR**  
**500,000 MILE BUS**  
**from**  
**OPTIMA BUS CORPORATION**  
**MODEL OPUS UNDER 32' LFB**  
**AUGUST 2006**  
**PTI-BT-R0612**

PENNSSTATE



**The Pennsylvania Transportation Institute**

201 Transportation Res. Bldg. (814) 865-1891  
The Pennsylvania State University  
University Park, PA 16802

**Bus Testing and Research Center**

2237 Old Route 220 N. (814) 695-3404  
Duncansville, PA 16635

# TABLE OF CONTENTS

	<u>Page</u>
EXECUTIVE SUMMARY .....	3
ABBREVIATIONS .....	5
BUS CHECK-IN .....	6
5. STRUCTURAL INTEGRITY	
5.2    STRUCTURAL STRENGTH AND DISTORTION TESTS - STRUCTURAL DISTORTION .....	16
5.3    STRUCTURAL STRENGTH AND DISTORTION TESTS - STATIC TOWING TEST .....	28
5.4    STRUCTURAL STRENGTH AND DISTORTION TESTS - DYNAMIC TOWING TEST .....	31

## EXECUTIVE SUMMARY

Optima Bus Corporation submitted a model Opus Under 32' LFB, diesel-powered 28 seat (including the driver) 31-foot bus, for a partial STURAA test in the 12 yr/500,000 mile category. The odometer reading at the time of delivery was 59,688 miles. The Federal Transit Administration determined that the following tests would be performed: 5.2 Structural Distortion Test, 5.3 Static Towing Test and 5.4 Dynamic Towing Test. Testing started on July 14, 2006 and was completed on July 21, 2006. The Check-In section of the report provides a description of the bus and specifies its major components.

The interior of the bus is configured with seating for 28 passengers including the driver. Free floor space will accommodate 22 standing passengers resulting in a potential load of 50 persons. At 150 lbs per person, this load results in a measured gross vehicle weight of 29,240 lbs.

The Distortion Test was completed with all subsystems, doors and escape mechanisms operating properly. Water leakage was observed throughout testing around the passenger entry door. (Finish work on both sides of the door is not installed). Leakage was also observed at the driver's side window and ran into the dash area.

The Static Towing Test was performed using a target load (towing force) of 26,904 lbs. All four front pulls were completed to the full test load with no damage or deformation observed. The Dynamic Towing Test was performed by means of a front-lift tow. The towing interface was accomplished using a hydraulic under-lift wrecker. The bus was towed without incident and no damage resulted from the test. The test bus was not equipped with rear tow eyes or tow hooks, therefore, a rear test was not performed.

## ABBREVIATIONS

ABTC	- Altoona Bus Test Center
A/C	- air conditioner
ADB	- advance design bus
ATA-MC	- The Maintenance Council of the American Trucking Association
CBD	- central business district
CW	- curb weight (bus weight including maximum fuel, oil, and coolant; but without passengers or driver)
dB(A)	- decibels with reference to 0.0002 microbar as measured on the "A" scale
DIR	- test director
DR	- bus driver
EPA	- Environmental Protection Agency
FFS	- free floor space (floor area available to standees, excluding ingress/egress areas, area under seats, area occupied by feet of seated passengers, and the vestibule area)
GVL	- gross vehicle load (150 lb for every designed passenger seating position, for the driver, and for each 1.5 sq ft of free floor space)
GVW	- gross vehicle weight (curb weight plus gross vehicle load)
GVWR	- gross vehicle weight rating
MECH	- bus mechanic
mpg	- miles per gallon
mph	- miles per hour
PM	- Preventive maintenance
PSBRTF	- Penn State Bus Research and Testing Facility
PTI	- Pennsylvania Transportation Institute
rpm	- revolutions per minute
SAE	- Society of Automotive Engineers
SCH	- test scheduler
SEC	- secretary
SLW	- seated load weight (curb weight plus 150 lb for every designed passenger seating position and for the driver)
STURAA	- Surface Transportation and Uniform Relocation Assistance Act
TD	- test driver
TECH	- test technician
TM	- track manager
TP	- test personnel

# TEST BUS CHECK-IN

## I. OBJECTIVE

The objective of this task is to log in the test bus, assign a bus number, complete the vehicle data form, and perform a safety check.

## II. TEST DESCRIPTION

The test consists of assigning a bus test number to the bus, cleaning the bus, completing the vehicle data form, obtaining any special information and tools from the manufacturer, determining a testing schedule, performing an initial safety check, and performing the manufacturer's recommended preventive maintenance. The bus manufacturer must certify that the bus meets all Federal regulations.

## III. DISCUSSION

The check-in procedure is used to identify in detail the major components and configuration of the bus.

The test bus consists of an Optima Bus Corporation, model Opus Under 32' LFB. The bus has a front door, equipped with Ricon model FR2SS01-10001000 fold-out handicap ramp, located forward of the front axle. Power is provided by a diesel-fueled, Cummins model ISB 245 engine coupled to a ZF model Ecomat 2 transmission.

The measured curb weight is 6,670 lbs for the front axle and 15,750 lbs for the rear axle. These combined weights provide a total measured curb weight of 22,420 lbs. There are 28 seats including the driver and room for 22 standing passengers bringing the total passenger capacity to 50. Gross load is  $150 \text{ lb} \times 50 = 7,500 \text{ lbs}$ . At full capacity, the measured gross vehicle weight is 29,240 lbs.

## VEHICLE DATA FORM

Bus Number: 0612	Arrival Date: 7-14-06
Bus Manufacturer: Optima Bus Corporation	Vehicle Identification Number (VIN): 109B6B9955W216332
Model Number: Opus Under 32' LFB	Date: 7-14-06
Personnel: T.S. & S.C.	

WEIGHT:

Individual Wheel Reactions:

Weights (lb)	Front Axle		Middle Axle		Rear Axle	
	Right	Left	Right	Left	Right	Left
CW	3,340	3,330	N/A	N/A	7,580	8,170
SLW	3,630	3,700	N/A	N/A	9,230	9,910
GVW	4,360	4,410	N/A	N/A	9,920	10,550

Total Weight Details:

Weight (lb)	CW	SLW	GVW	GAWR
Front Axle	6,670	7,330	8,770	10,710
Middle Axle	N/A	N/A	N/A	N/A
Rear Axle	15,750	19,140	20,470	20,280
Total	22,420	26,470	29,240	GVWR: 30,000

Dimensions:

Length (ft/in)	31 / 11.25
Width (in)	99.5
Height (in)	127.0
Front Overhang (in)	106.0
Rear Overhang (in)	112.25
Wheel Base (in)	165.0
Wheel Track (in)	Front: 86.0
	Rear: 78.3

Bus Number: 0612	Date: 7-14-06
------------------	---------------

**CLEARANCES:**

Lowest Point Outside Front Axle	Location: Skid plate	Clearance(in): 8.4
Lowest Point Outside Rear Axle	Location: Air dryer	Clearance(in): 6.6
Lowest Point between Axles	Location: Air tank	Clearance(in): 7.7
Ground Clearance at the center (in)	6.9	
Front Approach Angle (deg)	8.3	
Rear Approach Angle (deg)	6.9	
Ramp Clearance Angle (deg)	4.8	
Aisle Width (in)	22.5	
Inside Standing Height at Center Aisle (in)	Front – 101.0    Rear – 80.0	

**BODY DETAILS:**

Body Structural Type	Monocoque		
Frame Material	Steel		
Body Material	Aluminum & fiberglass		
Floor Material	Composite		
Roof Material	Aluminum & fiberglass		
Windows Type	<input type="checkbox"/> Fixed	<input checked="" type="checkbox"/> Movable	
Window Mfg./Model No.	Viracon / ASI M-103 DOT 129		
Number of Doors	<u>  1  </u> Front	<u>  0  </u> Rear	
Mfr. / Model No.	Peters Door Systems / Slide Glide		
Dimension of Each Door (in)	Front – 37.1 x 79.6		
Passenger Seat Type	<input checked="" type="checkbox"/> Cantilever	<input type="checkbox"/> Pedestal	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	Freedman Seating Co. / Citi Seat		
Driver Seat Type	<input checked="" type="checkbox"/> Air	<input type="checkbox"/> Spring	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	Recaro / Ergo Metro Air Ride		
Number of Seats (including Driver)	28		

Bus Number: 0612	Date: 7-14-06
------------------	---------------

BODY DETAILS (Contd..)

Free Floor Space ( ft <sup>2</sup> )	33.4				
Height of Each Step at Normal Position (in)	Front	1. <u>14.0</u>	2. <u>N/A</u>	3. <u>N/A</u>	4. <u>N/A</u>
	Middle	1. <u>N/A</u>	2. <u>N/A</u>	3. <u>N/A</u>	4. <u>N/A</u>
	Rear	1. <u>N/A</u>	2. <u>N/A</u>	3. <u>N/A</u>	4. <u>N/A</u>
Step Elevation Change - Kneeling (in)	4.5				

ENGINE

Type	<input checked="" type="checkbox"/> C.I.	<input type="checkbox"/> Alternate Fuel	
	<input type="checkbox"/> S.I.	<input type="checkbox"/> Other (explain)	
Mfr. / Model No.	Cummins / ISB 245		
Location	<input type="checkbox"/> Front	<input checked="" type="checkbox"/> Rear	<input type="checkbox"/> Other (explain)
Fuel Type	<input type="checkbox"/> Gasoline	<input type="checkbox"/> CNG	<input type="checkbox"/> Methanol
	<input checked="" type="checkbox"/> Diesel	<input type="checkbox"/> LNG	<input type="checkbox"/> Other (explain)
Fuel Tank Capacity (indicate units)	75 gals		
Fuel Induction Type	<input type="checkbox"/> Injected	<input checked="" type="checkbox"/> Carburetion	
Fuel Injector Mfr. / Model No.	Cummins / ISB 245		
Carburetor Mfr. / Model No.	N/A		
Fuel Pump Mfr. / Model No.	Cummins / ISB 245		
Alternator (Generator) Mfr. / Model No.	C.E. Niehoff & Co. / C706		
Maximum Rated Output (Volts / Amps)	28 / 300		
Air Compressor Mfr. / Model No.	Na / Na		
Maximum Capacity (ft <sup>3</sup> / min)	15.2		
Starter Type	<input checked="" type="checkbox"/> Electrical	<input type="checkbox"/> Pneumatic	<input type="checkbox"/> Other (explain)
Starter Mfr. / Model No.	Delco-Remy / 1113277		



Bus Number: 0612	Date: 7-14-06
------------------	---------------

TRANSMISSION

Transmission Type	<input type="checkbox"/> Manual	<input checked="" type="checkbox"/> Automatic	
Mfr. / Model No.	ZF / Ecomat 2		
Control Type	<input type="checkbox"/> Mechanical	<input checked="" type="checkbox"/> Electrical	<input type="checkbox"/> Other
Torque Converter Mfr. / Model No.	ZF / Ecomat 2		
Integral Retarder Mfr. / Model No.	ZF / Ecomat 2		

SUSPENSION

Number of Axles	2		
Front Axle Type	<input type="checkbox"/> Independent	<input checked="" type="checkbox"/> Beam Axle	
Mfr. / Model No.	Arvin Meritor / MFS12155ANL		
Axle Ratio (if driven)	N/A		
Suspension Type	<input checked="" type="checkbox"/> Air	<input type="checkbox"/> Spring	<input type="checkbox"/> Other
No. of Shock Absorbers	2		
Mfr. / Model No.	Koni / 90-2610SP1		
Middle Axle Type	<input type="checkbox"/> Independent	<input type="checkbox"/> Beam Axle	
Mfr. / Model No.	N/A		
Axle Ratio (if driven)	N/A		
Suspension Type	<input type="checkbox"/> Air	<input type="checkbox"/> Spring	<input type="checkbox"/> Other
No. of Shock Absorbers	N/A		
Mfr. / Model No.	N/A		
Rear Axle Type	<input type="checkbox"/> Independent	<input checked="" type="checkbox"/> Beam Axle	
Mfr. / Model No.	Arvin Meritor / RS21145KFLF617		
Axle Ratio (if driven)	5:29		
Suspension Type	<input checked="" type="checkbox"/> Air	<input type="checkbox"/> Spring	<input type="checkbox"/> Other
No. of Shock Absorbers	2		
Mfr. / Model No.	Koni / 90-2611		

Bus Number: 0612	Date: 7-14-06
------------------	---------------

**WHEELS & TIRES**

Front	Wheel Mfr./ Model No.	Accuride / 19.5 x 7.5
	Tire Mfr./ Model No.	Michelin XZE2+ / 265/70R 19.5
Rear	Wheel Mfr./ Model No.	Accuride / 19.5 x 7.5
	Tire Mfr./ Model No.	Michelin XZE2+ / 265/70R 19.5

**BRAKES**

Front Axle Brakes Type	<input checked="" type="checkbox"/> Cam	<input type="checkbox"/> Disc	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	Arvin Meritor / 15 x 6 Q Plus		
Middle Axle Brakes Type	<input type="checkbox"/> Cam	<input type="checkbox"/> Disc	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	N/A		
Rear Axle Brakes Type	<input checked="" type="checkbox"/> Cam	<input type="checkbox"/> Disc	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	Arvin Meritor / 15 x 8.63 Q Plus		
Retarder Type	Integral Hydraulic Transmission Brake		
Mfr. / Model No.	ZR / Ecomat 2		

**HVAC**

Heating System Type	<input type="checkbox"/> Air	<input checked="" type="checkbox"/> Water	<input type="checkbox"/> Other
Capacity (Btu/hr)	110,000		
Mfr. / Model No.	Thermo King / LRT-SP		
Air Conditioner	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	
Location	Exterior roof mount.		
Capacity (Btu/hr)	95,000		
A/C Compressor Mfr. / Model No.	Thermo King / 8391LS		

**STEERING**

Steering Gear Box Type	Hydraulic gear
Mfr. / Model No.	Ross / TRW
Steering Wheel Diameter	20.0
Number of turns (lock to lock)	4.75

Bus Number: 0612	Date: 7-14-06
------------------	---------------

OTHERS

Wheel Chair Ramps	Location: Front door	Type: Fold out ramp
Wheel Chair Lifts	Location: N/A	Type: N/A
Mfr. / Model No.	Ricon / FR2SS01-10001000	
Emergency Exit	Location: Window Door Roof Hatch	Number: 3 1 1

CAPACITIES

Fuel Tank Capacity (units)	75 gals
Engine Crankcase Capacity (gallons)	4.0
Transmission Capacity (gallons)	6.5
Differential Capacity (gallons)	3.75
Cooling System Capacity (quarts)	19.0
Power Steering Fluid Capacity (gallons)	5.0



## COMPONENT/SUBSYSTEM INSPECTION FORM

Bus Number: 0612	Date: 7-14-06
------------------	---------------

Subsystem	Checked	Comments
Air Conditioning Heating and Ventilation		Right side rear view mirror cannot be viewed from the driver's seat.
Body and Sheet Metal		Large gaps around both sides of the entry door. (Unfinished) ?
Frame		
Steering		
Suspension		
Interior/Seating		
Axles		
Brakes		
Tires/Wheels		
Exhaust		
Fuel System		
Power Plant		
Accessories		
Lift System		
Interior Fasteners		
Batteries		

## CHECK - IN



## OPTIMA BUS CORPORATION MODEL OPUS UNDER 32' LFB



**CHECK - IN CONT.**



**OPTIMA BUS CORPORATION  
MODEL OPUS UNDER 32' LFB  
EQUIPPED WITH A  
RICON MODEL FR2SS01-10001000  
HANDICAP RAMP**

## **5.2 STRUCTURAL STRENGTH AND DISTORTION TESTS - STRUCTURAL DISTORTION**

### **5.2-I. TEST OBJECTIVE**

The objective of this test is to observe the operation of the bus subsystems when the bus is placed in a longitudinal twist simulating operation over a curb or through a pothole.

### **5.2-II. TEST DESCRIPTION**

With the bus loaded to GVWR, each wheel of the bus will be raised (one at a time) to simulate operation over a curb and the following will be inspected:

1. Body
2. Windows
3. Doors
4. Roof vents
5. Special seating
6. Undercarriage
7. Engine
8. Service doors
9. Escape hatches
10. Steering mechanism

Each wheel will then be lowered (one at a time) to simulate operation through a pothole and the same items inspected.

### **5.2-III. DISCUSSION**

The test sequence was repeated ten times. The first and last test is with all wheels level. The other eight tests are with each wheel 6 inches higher and 6 inches lower than the other three wheels.

All doors, windows, escape mechanisms, engine, steering and handicapped devices operated normally throughout the test. The undercarriage and body indicated no deficiencies. Water leakage was observed throughout testing around the passenger entry door. (Finish work on both sides of the door is not installed). Leakage was also observed at the driver's side window and ran into the dash area. The results of this test are indicated on the following data forms.



**DISTORTION TEST INSPECTION FORM**  
 (Note: Ten copies of this data sheet are required)

Bus Number: 0612		Date: 7-17-06
Personnel: G.M., P.D., G.P., D.V. & S.C.		Temperature(°F): 78
Wheel Position : (check one)		
All wheels level	<input checked="" type="checkbox"/> before	<input type="checkbox"/> after
Left front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right center	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left center	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
	<b>Comments</b>	
<input checked="" type="checkbox"/> Windows	No deficiencies.	
<input checked="" type="checkbox"/> Front Doors	Excessive leakage. Trim work around door is incomplete. 1½" to 2" gap on both sides.	
<input checked="" type="checkbox"/> Rear Doors	N/A	
<input checked="" type="checkbox"/> Escape Mechanisms/ Roof Vents	No deficiencies.	
<input checked="" type="checkbox"/> Engine	No deficiencies.	
<input checked="" type="checkbox"/> Handicapped Device/ Special Seating	No deficiencies.	
<input checked="" type="checkbox"/> Undercarriage	No deficiencies.	
<input checked="" type="checkbox"/> Service Doors	No deficiencies.	
<input checked="" type="checkbox"/> Body	No deficiencies.	
<input checked="" type="checkbox"/> Windows/ Body Leakage	Driver's side window. Leakage half way up corner pillar. Leak ran into dash area.	
<input checked="" type="checkbox"/> Steering Mechanism	No deficiencies.	

**DISTORTION TEST INSPECTION FORM**  
 (Note: Ten copies of this data sheet are required)

Bus Number: 0612		Date: 7-17-06
Personnel: G.M., P.D., G.P., D.V. & S.C.		Temperature(°F): 78
Wheel Position : (check one)		
All wheels level	<input type="checkbox"/> before	<input type="checkbox"/> after
Left front	<input checked="" type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right center	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left center	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
	<b>Comments</b>	
■ Windows	No deficiencies.	
■ Front Doors	Excessive leakage. Trim work around door is incomplete. 1½" to 2" gap on both sides.	
■ Rear Doors	N/A	
■ Escape Mechanisms/ Roof Vents	No deficiencies.	
■ Engine	No deficiencies.	
■ Handicapped Device/ Special Seating	No deficiencies.	
■ Undercarriage	No deficiencies.	
■ Service Doors	No deficiencies.	
■ Body	No deficiencies.	
■ Windows/ Body Leakage	Driver's side window. Leakage half way up corner pillar. Leak ran into dash area.	
■ Steering Mechanism	No deficiencies.	

**DISTORTION TEST INSPECTION FORM**  
 (Note: Ten copies of this data sheet are required)

Bus Number: 0612		Date: 7-17-06
Personnel: G.M., P.D., G.P., D.V. & S.C.		Temperature(°F): 78
Wheel Position : (check one)		
All wheels level	<input type="checkbox"/> before	<input type="checkbox"/> after
Left front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right front	<input checked="" type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right center	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left center	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
	<b>Comments</b>	
■ Windows	No deficiencies.	
■ Front Doors	Excessive leakage. Trim work around door is incomplete. 1½" to 2" gap on both sides.	
■ Rear Doors	N/A	
■ Escape Mechanisms/ Roof Vents	No deficiencies.	
■ Engine	No deficiencies.	
■ Handicapped Device/ Special Seating	No deficiencies.	
■ Undercarriage	No deficiencies.	
■ Service Doors	No deficiencies.	
■ Body	No deficiencies.	
■ Windows/ Body Leakage	Driver's side window. Leakage half way up corner pillar. Leak ran into dash area.	
■ Steering Mechanism	No deficiencies.	

**DISTORTION TEST INSPECTION FORM**  
 (Note: Ten copies of this data sheet are required)

Bus Number: 0612		Date: 7-17-06
Personnel: G.M., P.D., G.P., D.V. & S.C.		Temperature(°F): 78
Wheel Position : (check one)		
All wheels level	<input type="checkbox"/> before	<input type="checkbox"/> after
Left front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right rear	<input checked="" type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right center	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left center	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
	<b>Comments</b>	
■ Windows	No deficiencies.	
■ Front Doors	Excessive leakage. Trim work around door is incomplete. 1½" to 2" gap on both sides.	
■ Rear Doors	N/A	
■ Escape Mechanisms/ Roof Vents	No deficiencies.	
■ Engine	No deficiencies.	
■ Handicapped Device/ Special Seating	No deficiencies.	
■ Undercarriage	No deficiencies.	
■ Service Doors	No deficiencies.	
■ Body	No deficiencies.	
■ Windows/ Body Leakage	Driver's side window. Leakage half way up corner pillar. Leak ran into dash area.	
■ Steering Mechanism	No deficiencies.	

**DISTORTION TEST INSPECTION FORM**  
 (Note: Ten copies of this data sheet are required)

Bus Number: 0612		Date: 7-17-06
Personnel: G.M., P.D., G.P., D.V. & S.C.		Temperature(°F): 78
Wheel Position : (check one)		
All wheels level	<input type="checkbox"/> before	<input type="checkbox"/> after
Left front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left rear	<input checked="" type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right center	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left center	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
	<b>Comments</b>	
■ Windows	No deficiencies.	
■ Front Doors	Excessive leakage. Trim work around door is incomplete. 1½" to 2" gap on both sides.	
■ Rear Doors	N/A	
■ Escape Mechanisms/ Roof Vents	No deficiencies.	
■ Engine	No deficiencies.	
■ Handicapped Device/ Special Seating	No deficiencies.	
■ Undercarriage	No deficiencies.	
■ Service Doors	No deficiencies.	
■ Body	No deficiencies.	
■ Windows/ Body Leakage	Driver's side window. Leakage half way up corner pillar. Leak ran into dash area.	
■ Steering Mechanism	No deficiencies.	

**DISTORTION TEST INSPECTION FORM**  
 (Note: Ten copies of this data sheet are required)

Bus Number: 0612		Date: 7-17-06
Personnel: G.M., P.D., G.P., D.V. & S.C.		Temperature(°F): 78
Wheel Position : (check one)		
All wheels level	<input type="checkbox"/> before	<input type="checkbox"/> after
Left front	<input type="checkbox"/> 6 in higher	<input checked="" type="checkbox"/> 6 in lower
Right front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right center	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left center	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
	<b>Comments</b>	
■ Windows	No deficiencies.	
■ Front Doors	Excessive leakage. Trim work around door is incomplete. 1½" to 2" gap on both sides.	
■ Rear Doors	N/A	
■ Escape Mechanisms/ Roof Vents	No deficiencies.	
■ Engine	No deficiencies.	
■ Handicapped Device/ Special Seating	No deficiencies.	
■ Undercarriage	No deficiencies.	
■ Service Doors	No deficiencies.	
■ Body	No deficiencies.	
■ Windows/ Body Leakage	Driver's side window. Leakage half way up corner pillar. Leak ran into dash area.	
■ Steering Mechanism	No deficiencies.	

**DISTORTION TEST INSPECTION FORM**  
 (Note: Ten copies of this data sheet are required)

Bus Number: 0612		Date: 7-17-06
Personnel: G.M., P.D., G.P., D.V. & S.C.		Temperature(°F): 78
Wheel Position : (check one)		
All wheels level	<input type="checkbox"/> before	<input type="checkbox"/> after
Left front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right front	<input type="checkbox"/> 6 in higher	<input checked="" type="checkbox"/> 6 in lower
Right rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right center	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left center	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
	<b>Comments</b>	
■ Windows	No deficiencies.	
■ Front Doors	Excessive leakage. Trim work around door is incomplete. 1½" to 2" gap on both sides.	
■ Rear Doors	N/A	
■ Escape Mechanisms/ Roof Vents	No deficiencies.	
■ Engine	No deficiencies.	
■ Handicapped Device/ Special Seating	No deficiencies.	
■ Undercarriage	No deficiencies.	
■ Service Doors	No deficiencies.	
■ Body	No deficiencies.	
■ Windows/ Body Leakage	Driver's side window. Leakage half way up corner pillar. Leak ran into dash area.	
■ Steering Mechanism	No deficiencies.	

**DISTORTION TEST INSPECTION FORM**  
 (Note: Ten copies of this data sheet are required)

Bus Number: 0612		Date: 7-17-06
Personnel: G.M., P.D., G.P., D.V. & S.C.		Temperature(°F): 78
Wheel Position : (check one)		
All wheels level	<input type="checkbox"/> before	<input type="checkbox"/> after
Left front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right rear	<input type="checkbox"/> 6 in higher	<input checked="" type="checkbox"/> 6 in lower
Left rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right center	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left center	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
	<b>Comments</b>	
■ Windows	No deficiencies.	
■ Front Doors	Excessive leakage. Trim work around door is incomplete. 1½" to 2" gap on both sides.	
■ Rear Doors	N/A	
■ Escape Mechanisms/ Roof Vents	No deficiencies.	
■ Engine	No deficiencies.	
■ Handicapped Device/ Special Seating	No deficiencies.	
■ Undercarriage	No deficiencies.	
■ Service Doors	No deficiencies.	
■ Body	No deficiencies.	
■ Windows/ Body Leakage	Driver's side window. Leakage half way up corner pillar. Leak ran into dash area.	
■ Steering Mechanism	No deficiencies.	



**DISTORTION TEST INSPECTION FORM**  
 (Note: Ten copies of this data sheet are required)

Bus Number: 0612		Date: 7-17-06
Personnel: G.M., P.D., G.P., D.V. & S.C.		Temperature(°F): 78
Wheel Position : (check one)		
All wheels level	<input type="checkbox"/> before	<input type="checkbox"/> after
Left front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left rear	<input type="checkbox"/> 6 in higher	<input checked="" type="checkbox"/> 6 in lower
Right center	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left center	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
	<b>Comments</b>	
■ Windows	No deficiencies.	
■ Front Doors	Excessive leakage. Trim work around door is incomplete. 1½" to 2" gap on both sides.	
■ Rear Doors	N/A	
■ Escape Mechanisms/ Roof Vents	No deficiencies.	
■ Engine	No deficiencies.	
■ Handicapped Device/ Special Seating	No deficiencies.	
■ Undercarriage	No deficiencies.	
■ Service Doors	No deficiencies.	
■ Body	No deficiencies.	
■ Windows/ Body Leakage	Driver's side window. Leakage half way up corner pillar. Leak ran into dash area.	
■ Steering Mechanism	No deficiencies.	

**DISTORTION TEST INSPECTION FORM**  
 (Note: Ten copies of this data sheet are required)

Bus Number: 0612		Date: 7-17-06
Personnel: G.M., P.D., G.P., D.V. & S.C.		Temperature(°F): 78
Wheel Position : (check one)		
All wheels level	<input type="checkbox"/> before	<input checked="" type="checkbox"/> after
Left front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right center	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left center	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
	<b>Comments</b>	
<input checked="" type="checkbox"/> Windows	No deficiencies.	
<input checked="" type="checkbox"/> Front Doors	Excessive leakage. Trim work around door is incomplete. 1½" to 2" gap on both sides.	
<input checked="" type="checkbox"/> Rear Doors	N/A	
<input checked="" type="checkbox"/> Escape Mechanisms/ Roof Vents	No deficiencies.	
<input checked="" type="checkbox"/> Engine	No deficiencies.	
<input checked="" type="checkbox"/> Handicapped Device/ Special Seating	No deficiencies.	
<input checked="" type="checkbox"/> Undercarriage	No deficiencies.	
<input checked="" type="checkbox"/> Service Doors	No deficiencies.	
<input checked="" type="checkbox"/> Body	No deficiencies.	
<input checked="" type="checkbox"/> Windows/ Body Leakage	Driver's side window. Leakage half way up corner pillar. Leak ran into dash area.	
<input checked="" type="checkbox"/> Steering Mechanism	No deficiencies.	

## 5.2 STRUCTURAL DISTORTION TEST



**RIGHT FRONT WHEEL SIX INCHES HIGHER**



**LEFT FRONT WHEEL SIX INCHES LOWER**

## **5.3 STRUCTURAL STRENGTH AND DISTORTION TESTS - STATIC TOWING TEST**

### **5.3-I. TEST OBJECTIVE**

The objective of this test is to determine the characteristics of the bus towing mechanisms under static loading conditions.

### **5.3-II. TEST DESCRIPTION**

Utilizing a load-distributing yoke, a hydraulic cylinder is used to apply a static tension load equal to 1.2 times the bus curb weight. The load will be applied to both the front and rear, if applicable, towing fixtures at an angle of 20 degrees with the longitudinal axis of the bus, first to one side then the other in the horizontal plane, and then upward and downward in the vertical plane. Any permanent deformation or damage to the tow eyes or adjoining structure will be recorded.

### **5.3-III. DISCUSSION**

The load-distributing yoke was incorporated as the interface between the Static Tow apparatus and the test bus tow hook/eyes. A front test was performed to the full target test weight of 26,904 lbs (1.2 x 22,420 lbs CW). No damage or deformation was observed during all four pulls of the test. The test bus was not equipped with rear tow eyes or tow hooks, therefore, a rear test was not performed.

### STATIC TOWING TEST DATA FORM

Bus Number: 0612	Date: 7-18-06
Personnel: S.C., G.P., D.V. & C.S.	Temperature (°F): 83

<b>Inspect right front tow eye and adjoining structure.</b>
<b>Comments:</b> No damage or deformation observed.
<b>Check the torque of all bolts attaching tow eye and surrounding structure.</b>
<b>Comments:</b> All welds verified.
<b>Inspect left tow eye and adjoining structure.</b>
<b>Comments:</b> No damage or deformation observed.
<b>Check the torque of all bolts attaching tow eye and surrounding structure.</b>
<b>Comments:</b> All welds verified.
<b>Inspect right rear tow eye and adjoining structure.</b>
<b>Comments:</b> N/A
<b>Check the torque of all bolts attaching tow eye and surrounding structure.</b>
<b>Comments:</b> N/A
<b>Inspect left rear tow eye and adjoining structure.</b>
<b>Comments:</b> N/A
<b>Check the torque of all bolts attaching tow eye and surrounding structure.</b>
<b>Comments:</b> N/A
<b>General comments of any other structure deformation or failure:</b> All four front pulls were completed to the full target test load of 26,904 lbs (1.2 x 22,420 lbs CW) with no damage or deformation observed. The test bus was not equipped with rear tow eyes or hooks, therefore, a rear test was not performed.

### 5.3 STATIC TOWING TEST



**FRONT 20° UP PULL**



**FRONT 20° DOWN PULL**

## **5.4 STRUCTURAL STRENGTH AND DISTORTION TESTS - DYNAMIC TOWING TEST**

### **5.4-I. TEST OBJECTIVE**

The objective of this test is to verify the integrity of the towing fixtures and determine the feasibility of towing the bus under manufacturer specified procedures.

### **5.4-II. TEST DESCRIPTION**

This test requires the bus be towed at curb weight using the specified equipment and instructions provided by the manufacturer and a heavy-duty wrecker. The bus will be towed for 5 miles at a speed of 20 mph for each recommended towing configuration. After releasing the bus from the wrecker, the bus will be visually inspected for any structural damage or permanent deformation. All doors, windows and passenger escape mechanisms will be inspected for proper operation.

### **5.4-III. DISCUSSION**

The bus was towed using a heavy-duty wrecker. The towing interface was accomplished by incorporating a hydraulic under lift. A front lift tow was performed. No problems, deformation, or damage was noted during testing. The rear of the test bus was not equipped with tow eyes or tow hooks, therefore, a rear tow was not performed.

## DYNAMIC TOWING TEST DATA FORM

Bus Number: 0612	Date: 7-19-06
Personnel: S.C. & G.P.	

Temperature (°F): 83	Humidity (%): 59
Wind Direction: SW	Wind Speed (mph): 5 - 8
Barometric Pressure (in.Hg): 30.06	

<b>Inspect tow equipment-bus interface.</b>
<b>Comments:</b> A safe and adequate connection was made between the tow equipment and the bus.
<b>Inspect tow equipment-wrecker interface.</b>
<b>Comments:</b> A safe and adequate connection was made between the tow equipment and the wrecker.
<b>Towing Comments:</b> A front lift tow was performed incorporating a hydraulic under lift wrecker.
<b>Description and location of any structural damage:</b> None noted.
<b>General Comments:</b> No problems with the tow or towing interface were encountered. The rear of the test bus was not equipped with tow eyes or tow hooks, therefore, a rear tow was not performed.



## 5.4 DYNAMIC TOWING TEST



## TOWING INTERFACE



## TEST BUS IN TOW

Filename: Report.0612.doc  
Directory: E:  
Template: C:\Documents and Settings\vnocek\Application  
Data\Microsoft\Templates\Normal.dot  
Title: 5  
Subject:  
Author: Sondra Hoover  
Keywords:  
Comments:  
Creation Date: 8/11/2006 9:21:00 AM  
Change Number: 2  
Last Saved On: 8/11/2006 9:21:00 AM  
Last Saved By: Sandy Hoover  
Total Editing Time: 0 Minutes  
Last Printed On: 2/2/2007 9:27:00 AM  
As of Last Complete Printing  
Number of Pages: 33  
Number of Words: 5,210 (approx.)  
Number of Characters: 24,855 (approx.)